RESEARCH AND WORKING PAPERS ▫ 30

VARIATION IN THE COST AND USE OF WINTER HOME HEATING AMONG THE INDEPENDENT ELDERLY: A CASE STUDY OF WATERLOO (1986)

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with Robert Boyce,
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103-07256/

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Research and Working Paper 30

by

Dr. Brent Hall

with the assistance of

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Randy Secord
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This project was carried out with the financial assistance of a Summer Experience '86 Grant from the Ontario Ministry of Energy. The views expressed are those of the authors and do not represent the official views of the Ministry.

Institute of Urban Studies

1987

PUBLICATION DATA

Hall, Brent
Variation in the cost and use of winter home heating

(Research and Working Papers; 30)

ISBN: 0-920213-48-0

I. Boyce, Robert; Secord, Randy; Van Landschoot, Carl. II. University of Winnipeg. Institute of Urban Studies. III. Title. IV. Series: Research and Working paper (University of Winnipeg. Institute of Urban Studies); 30.

This publication was partially supported by the Canada Mortgage and Housing Corporation, but the views expressed are the personal views of the authors and the Corporation accepts no responsibility for them.

Published by:

INSTITUTE OF URBAN STUDIES
University of Winnipeg
515 Portage Avenue
Winnipeg, Manitoba
R3B 2E9 CANADA
Tel: (204) 786-9409

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ISBN: 0-920213-48-0

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1.0 INTRODUCTION

1.1 Overview and Statement of Objectives

As the number of elderly increase in relation to the rest of the population, the needs of the elderly sub-group will become increasingly important as a tour de force in all areas of planning and policy. Some of these needs include the provision and maintenance of proper health standards and a sufficient income to maintain a decent quality of life. Without government intervention, either directly or indirectly through the social service sector, the elderly would face considerable difficulties in maintaining the same standard of living after retirement that they achieved during their working years. This is particularly true in the context of individuals who are faced with the problems of declining health and increased levels of dependency on others for everyday life. Yet, for the independent elderly, the maintenance of comfort is an equally important concern and often far from a fait accomplis after retirement.

The research reported in this document is concerned with a particular aspect of comfort among the non-institutionalized, independent elderly, namely the use of adequate home heating during the harsh Canadian winter months. The concept of comfort, in this context, has at least two important meanings. First, comfort implies the financial and physical ability to provide home heating at a level that does not result in the deterioration of health. This is a particularly important consideration for the elderly who generally are more immobile than the population at large. They, therefore, spend more time at home than other demographic age groups, especially during the winter. Second, comfort is also an experiential, bodily state that is achieved, in the context of the present study, by the use of adequate winter home heating. Thus, comfort also has implications for economic well-being in the sense that home heating is expensive, especially for those whose sole source of income is the Canada Pension and its supplements.

While it is possible to conceive of a person's comfort during winter as bodily well-being resulting from living in a warm home, it is equally

possible that this comfort may have been achieved at substantial discomfort in terms of financial cost. In fact, Gunn et. al, Older Canadian Homeowners: A Literature Review[1] suggests that as much as fifty per cent of the elderly incomes are absorbed by home heating costs during the winter. If this is indeed the case, winter home heating supply and its cost assumes a position of importance in determining the level of health and wealth of the elderly in Canada.

The general objective of the research in this volume is to determine whether or not there is a need for direct government intervention in subsidizing home heating use for the elderly. If a case for subsidization is established, this could take one of two forms, namely direct financial subsidy in terms of a winter home heating allowance for elderly households; or alternatively, indirect assistance by way of insulation and heating system modernization programs for this population subgroup. To determine (i) whether such assistance is required; (ii) if so, whether it should be means-tested and (iii) if so, by what criteria, are the specific objectives of this project. These objectives are satisfied by an analysis of home heating cost-income ratios for elderly subgroups defined by several criteria and a control sample of non-elderly households.

1.2 Structure of the Report

The second Chapter of this report presents a review of current literature relevant to the issue of winter home heating affordability and use by the independent elderly. From this review several hypotheses are stated for subsequent empirical analysis. Chapter three describes the sampling procedure used in the study, including the selection of subjects and survey response rate. Also the design of the questionnaire instrument and its content is discussed. In Chapter four the hypotheses are analyzed empirically and the socio-demographic characteristics of the sample group and control group are reported. The report is concluded in Chapter five with a summary of the major findings and the statement of a set of policy recommendations concerning winter home heating among the elderly.

2.0 HOUSING, INCOME AND THE COST OF WINTER HOME HEATING AMONG THE ELDERLY

Surprisingly little research examining housing and the cost of winter home heating among the independent elderly has been undertaken in Canada. In fact, prior to the present study there has been no research that focuses explicitly on the problem of winter home energy costs among the elderly resident in cold climatic environments.

The literature relevant to this topic cannot be thoroughly discussed without reviewing all of the factors that may affect the inability of the elderly to meet their home energy costs. This Chapter is organized as follows: first, current demographic and locational trends among Canada's elderly are discussed; second, income characteristics and home heating are outlined; third, present problems with home ownership and the emotional attachment of elderly to their homes are considered. The Chapter is concluded in section four with a statement of hypotheses that are subsequently tested empirically.

2.1 Demographic and Locational Trends of the Canadian Elderly

During the past decade the number of persons in Canada 60 years and over increased substantially, both in absolute number and as a proportion of the total population. To illustrate this, during the intercensal decade between 1971 and 1981, Canada's population as a whole increased 13% while the elderly subgroup, defined, in this case as 65 plus, increased by 35%.[2] According to recent estimates this sub-group will continue to increase numerically to 3.2 million persons or roughly 12% of the total population by the turn of the century and 18% by the year 2021.[3]

Within these general demographic trends, several occupancy characteristics describe the housing circumstances of the elderly. For example, in 1976 64% of elderly headed households were home-owners. Of these households 72% had male household heads, and of the female household heads, 50% owned their own homes. The population of women living alone increased from 15% in 1961 to 33% in 1976.[4] Clearly, this trend

significantly increases the number of single elderly women home-owners as a proportion of all elderly home-owners. The former sub-group of elderly is particularly vulnerable to increases in the cost of living considering that,

> ...the poverty rate among families headed by elderly women has increased since 1979 and now stands at an estimated 24.6%, two and one half times that for men.[5]

With projected increases in, especially, the seventy five to eighty plus age groups in forthcoming years, it is likely that present problems in catering to elderly needs will worsen, unless remedial action is taken.[6] This reality becomes even more acute when trends in the spatial distribution of the elderly population are taken into account. In this context, Moore and Rosenberg[7] report that, in absolute terms, the majority of elderly population are located in Ontario's largest urban areas. Yet, in relative terms, rural areas have higher per capita elderly populations. Of the urban elderly in Ontario, the trend is increasingly toward single (usually widowed) females living alone and, ultimately, institutional care.

Several authors have noted that concentrations of the elderly are found in older housing districts located in or near city core areas. Campbell, for example, states that concentrations of the older elderly are found primarily in the older housing stock of central-city areas.[8] Here, housing values are generally lower and there are relatively greater proportions of multifamily dwelling units and boarding houses than in suburban locations. A higher proportion of elderly, therefore, live in older homes that presumably require higher maintenance costs than newer dwellings. Moreover, it is well known that older residences are less heat efficient and require a relatively greater energy supply to maintain the same level of heat per unit area than a newer dwelling.[9] Clearly this suggests higher home heating costs for the same level of heat for residents of older dwellings. The implications of this proposition for the independent elderly are discussed in the following section.

2.2 Income Characteristics and Winter Home Heating of the Elderly

The income circumstances of the elderly are aptly summarized by Corke as follows:

> Considerable assistance is available for the elderly in terms of income support programs; community services; and special housing programs. However, despite the variety of programs, a particular subgroup of the population is consistently overlooked, despite the fact that they experience serious problems which frequently affect their general well being. This group consists of the elderly homeowners, many of whom are low income relative to the rest of the community.[10]

The consensus among researchers is that the Canadian government has been slow to provide financial and other services, especially, to the low income elderly. One argument in support of the status quo in policy suggests that the government deliberately resists legislating substantial income supplements to the elderly as their consumption needs are deemed to be less than the population at large. A second argument is that many policy makers and planners consider the elderly to be over-housed. This, in turn, is believed to delay the filtering down of larger houses in which the elderly reside to the next generation of younger and larger families. As a result, the government appears reluctant to support such occupancy characteristics through substantial elderly income supplement programs. A third and perhaps more cynical reason for government inactivity is that numerically the elderly have traditionally lacked sufficient weight of numbers to influence government policy. Clearly, this is changing. However, it does explain why a succession of governments have ignored elderly income needs.

The Canadian Pension Plan is perhaps the major source of income for elderly in this country. The adequacy of this program to meet elderly income needs is scrutinized in a 1985 task force report from Saskatchewan.[11] A rather bleak outlook is forecast for the elderly in this document:

> ...the lack of indexing and erosion of the pension in real dollar terms is problematic, as a pensioner ages his or her pension loses its purchasing power and in fact the pensioner slides down

> the income distribution array. This combined with rapid growth of the 75 age group could mean an even greater portion of low income seniors.[12]

The dominant view held by most authors is that inflation has significantly devalued the income supplied by the Canadian Pension Plan. In particular, the low income elderly suffer the most:

> The elderly are limited in the income and budgetary adjustments they can make to counteract inflationary trends as they have relative inflexibility in spending and few income alternatives. There the elderly can be greater victims of inflation than most of society.[13]

With increased home heating costs and only slowly increasing incomes in dollar terms relative to inflation, the elderly are in precarious circumstances. The low income elderly in particular are likely, again, to become increasingly unable to afford the financial wherewithal to meet the home heating costs required for maintenance of satisfactory bodily comfort during the winter months. This position is supported by one of the few studies that considers the affordability of winter home heating in the context of general shelter costs for the elderly in Canada.

> ...the affordability of shelter rented or owned, and in particular rising energy costs are problematic....Data from the 1978 Family Expenditure Survey show that energy costs represent 50% of the average shelter payment of elderly homeowners in Canada, with the balance divided between property taxes and repair and maintenance expenditures. Energy cost increases over the past few years have outstripped the adjustment of public sector pension plans which comprise the bulk of the income of most of the aging. This affects the affordability of all day to day activities of the aging.[14]

As noted above, most of the elderly are homeowners and they live in predominately older homes than the population at large. Moreover, evidence suggests that the elderly are cash income-poor. The relationship between these facts and the issue of home heating affordability is considered in the following section.

2.3 Problems Associated with Elderly Home Ownership

The proposition that the elderly do not experience heavy housing costs is common, since most elderly own their homes mortgage-free. However, the high operating costs associated with home ownership are exaggerated when the owner has a low income. Further, Brink reports from the results of a study of elderly homeowners in the United States that equity is a major contributor to net worth for the elderly who own their homes.[15] In 1976 in the United States, the average value of home equity was more than $36,000, accounting for half of the owner's wealth. However, even if they were to liquidate their other assets (on average $14,000) this would not yield much financial security.

The heavy onus of home operating costs on the elderly is summarized by the Social Planning Council of Metropolitan Toronto as follows:

> ...it may be admitted that property taxes bear severely on those who purchased their homes when their incomes were higher. Now, services, maintenance costs and taxes can account for a large portion of their modest pensions.[16]

Also, Brink notes that

> ...expenditures for housing and related expenses absorb approximately 50% of the elderly's total expenditures.[17]

It is clear that housing in need of repair will deteriorate rapidly if left unattended. As the elderly age, they become increasingly unable, both physically and financially, to maintain their homes. Under these circumstances, a deterioration spiral may occur whereby disrepair creates energy inefficiency, which increases cost, and reduces an already low disposable income. The worst scenario imaginable could include a cut back in the level of heating and electricity consumption which could result in serious health problems and perhaps even death.[18]

Despite this possibility, it is clear that elderly home owners do not wish to leave their long-term homes, even if problems do arise.[19] Rather than move, they prefer help that allows them to remain in familiar

surroundings as long as possible, even if this results in a functional and/or financial crisis.[20]

Evidence from Saskatchewan suggests that the cost of keeping the elderly in their own homes would cost that Province half the cost of maintaining them in an institution.[21] If this is the general case, it would be to the benefit of the government, the taxpayer and certainly the elderly to aid them in remaining in their own homes longer, before institutionalization becomes an absolute necessity. Moreover, advocates of independent living versus institutionalization argue that many elderly are fully capable of functioning in the community, given the choice and adequate financial and home support provision. The traumatic experience of moving from an independent or semi-independent life to an institution can leave deep impressions on the elderly which speed up the deterioration of mind and body.[22] There is an immediate need for policies that avoid this outcome and endorse the elderly preference for residence in their own homes.

In the following section a set of hypotheses that consider the living circumstances and winter home heating costs relative to income among the independent elderly in Waterloo, Ontario, are stated for subsequent analysis. Examination of these hypotheses forms the basis of the policy-related recommendations made in the concluding Chapter.

2.4 Research Hypotheses

The hypotheses stated in this section are derived from observations made in the literature review. In the absence of research that directly considers the issue of elderly winter home heating, hypotheses are based upon expectations that follow from suggestions implicit in the available elderly housing literature. There is a close relationship between the hypotheses and the objectives of this discussion as stated in Chapter One.

In order of examination the hypotheses are as follows:

Hypothesis 1: The older elderly (75 years plus) are primarily concentrated in the central city area of Waterloo.

Hypothesis 2: The elderly have a smaller number of total residents per household than the control group.

Hypothesis 3: In the elderly sample, females outnumber males and this especially holds for the older elderly.

Hypothesis 4: There is no significant difference in age group by sex for those elderly who live alone.

Hypothesis 5: A sizeable proportion of the elderly sample (>33%) are single, female homeowners.

Hypothesis 6: There is no significant difference in age group by sex for those elderly who live in multiple person households.

Hypothesis 7: There is a direct and significant relationship between the age of the respondent and the age of their dwelling.

Hypothesis 8: Hypothesis 7 holds for detached dwellings and semi-detached/townhouses individually.

Hypothesis 9: There is a direct and significant relationship between the age of a house and the age of its heating system, controlling for age of respondent.

Hypothesis 10: (i) The majority of elderly own their own homes, (ii) The majority of elderly homeowners do not have current mortgages.

Hypothesis 11: Dwelling construction material does not differ significantly by dwelling age.

Hypothesis 12: There is clear evidence of unused apace in houses occupied by elderly residents.

Hypothesis 13: There is no significant difference between dwelling age and type of home heating used, controlling for number of bedrooms occupied.

Hypothesis 14: Hypothesis 13 holds for age of respondent and type of home heating system.

Hypothesis 15: The majority of the overall sample (elderly plus control) spent at least the 1985 Ontario average ($775.00) on winter space heat last winter.

Hypothesis 16: The majority of elderly spent more than the 1985 Ontario average on winter space heat last winter.

Hypothesis 17: The majority of the whole sample spent less than $1.00 in $10.00 of household income on winter home heating last winter.

Hypothesis 18: The ratio of winter home heating costs to household income is at least $1.00 : $4.00 for the majority of the elderly.

Hypothesis 19: The mean total cost of winter home heating does not differ significantly between renters, mortgage holders and the residual elderly population.

Hypothesis 20: The mean ratio of winter home heating costs to household income does not differ significantly between the same three groups.

Hypothesis 21: Those elderly with a ratio of home heating costs to household of more than one dollar in six have different personal and housing characteristics to those with an equivalent ratio of less than one dollar in thirty.

Hypothesis 22: There is no significant difference in the mean ratio of home heating costs to household income for:
(i) those with and without insulation in their house
(ii) those with and without roof or wall or basement insulation

Hypothesis 23: Age of dwelling does not differ significantly between the elderly and control samples.

Hypothesis 24: There is no significant difference in mean household income between the control sample and the elderly sample, controlling for house age and size.

Hypothesis 25: Size of dwelling does not differ significantly between the elderly and control samples.

Hypothesis 26: There is no significant difference in the cost of winter home heating between the control sample and the elderly sample, controlling for house age and size.

Hypothesis 27: There is no significant difference in mean day time or mean night time temperature settings between the elderly and control samples, controlling for type and size of house.

Hypothesis 28: There is no significant difference in the mean monthly home heating to household income ratio between the elderly and the control sample.

Hypothesis 29: There is no significant difference in the mean ratio of home heating costs to household income between the control sample and the elderly sample, controlling for home age and size.

Hypothesis 30: Winter home heating cost in relation to income does not pose a problem to the majority of elderly.

3.0 RESEARCH DESIGN

3.1 Definitions and Sampling Procedure

The definition of elderly adopted in this study is 60 years of age and older, as of January, 1986. This definition is used rather than the more common mandatory retirement age of 65 years and older, as persons normally resident in Canada between the ages of 60 and 64 years are eligible for income subsidies from the Federal government and their Province of residence (see Appendix for an inventory of Federal and Province of Ontario Government assistance programs and their eligibility criteria).

The existence of early retirement programs (before 65) in conjunction with the availability of income subsidies for those 60 to 65 years of age in Ontario justifies the inclusion of this group in the definition of elderly used here. Moreover, the definition of elderly as those 60 years and older was adopted formally as an international standard by the World Council on Aging in 1984.

The City of Waterloo, Ontario is chosen as a case study not for any intrinsic reason other than the pragmatic advantages it offered to the researchers. The two main advantages may be listed as follows. First, data from Waterloo were available, in a manageable form, from which to assemble an as-complete-as-possible elderly population list by name, address and several other variables. Second, this population list allowed relatively easy selection of a random proportionate sample, stratified by two important control variables.

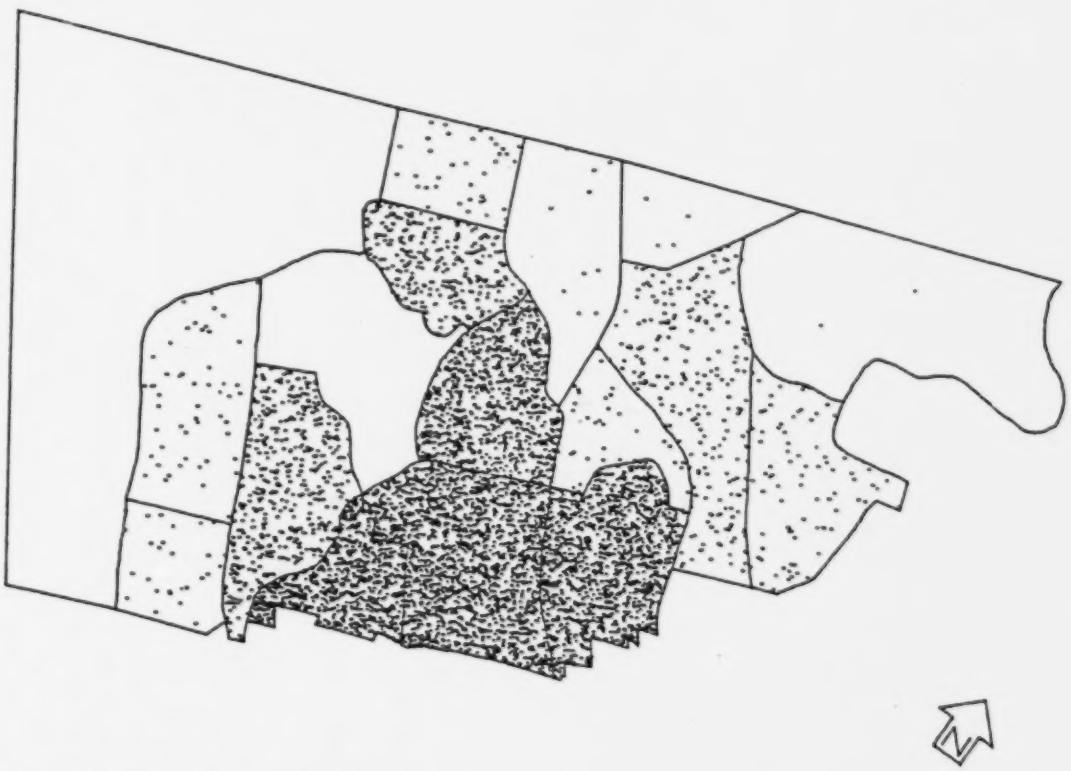
The Regional Municipality of Waterloo divides the city of Waterloo into 17 Major Planning Districts (MPDs). These planning districts serve no administrative function; they are intended solely as relatively homogeneous units defined for the purposes of data collection and analysis by the

Region and City Planning Departments. Street names and addresses were derived from Vernon's City Directory (1984) and assigned to appropriate MPDs as a preliminary to population and sample identification. The assignment of addresses to districts allowed the distribution of the elderly to be plotted as points (addresses) in space or by a choropleth map to ensure spatial and numerical representation of the population of elderly in sample selection.

In order to achieve an accurate sample of elderly residents in Waterloo City, it was first necessary to identify the relevant population by street address. This task is problematic as it is often impossible to identify the elderly from the non-elderly population. Information publicly available, such as the census, does not usually identify individuals by age and address. After some researching of local records it was discovered that the names, addresses, sex and age of all residents of Waterloo in 1984 were maintained at Waterloo City Hall on the Municipal School Tax List. For subsequent years (1985 and 1986) the ages had been erased from the tax list file rendering identification of the elderly from the non-elderly a practical impossibility for these years. Thus the 1984 list was used and corrected to the present by the addition of two years to all ages, as of 1984. Those individuals who were above the age of 59 as of January 1986 were copied into a separate file and used as the target population in this study. The target population of elderly in Waterloo as of January 1986 was 6206; their distribution by MPD is shown in Figure 3.1. As one would expect, based upon existing research, the major concentrations of elderly coincide with the downtown MPDs and numbers vary between districts according to aging in place and elderly in-migration to districts offering specialized accommodation.

From the 6206 addresses copied from the school tax list, the elderly were classified according to five variables, namely location, age, sex, house type and living accommodation (Table 3.1). Of these variables, it was decided that house type and living accommodation were crucial in the context of winter home heating. They were therefore retained as the control variables with which to stratify the sample of elderly to be

FIGURE 3.1: [1] SPATIAL DISTRIBUTION OF ELDERLY (60 PLUS) POPULATION BY MAJOR PLANNING DISTRICTS CITY OF WATERLOO, 1986



[1] N=6118. This excludes 88 elderly residents with p.o. box numbers and rural route addresses since their exact location is unknown.

NOTE: one dot equals one elderly occupied dwelling

interviewed. The distribution of elderly by these two variables is shown in Table 3.2. Upon further reflection it was decided that house types 3 and 5 should be excluded as the heating systems and their running costs are usually incorporated within the building (i.e. thermostatically set) and rent payments respectively. Thus it is impossible to determine how much is spent on heating exclusive of rent and to determine how much energy is consumed per accommodation unit.

TABLE 3.1

Definition of Variables Used in Sample Selection

Variable	Definition (and Measurement)
Location	Street address from city school tax list assigned to Major Planning District
Sex	Male / Female (Nominal)
Age	In years as of 1986 (Ratio and Nominal)
House type	Detached house; semi-detached dwelling; apartment; rural route; unit segregated building; suite segregated building; post office box number (nominal)
Accommodation Status	Live above; couple with same surname, different sex in same residence; couple of same sex in same residence (nominal)

TABLE 3.2

Crosstabulation of Elderly Population by
House Type of Residence and Accommodation Status

		ACCOMMODATION STATUS							
		Living Alone		Couple of Different Sex		Couple of Same Sex		TOTAL	
		n	%	n	%	n	%	n	%
HOUSE TYPE	Détached Dwelling	1750	28.2	2506	40.4	12	0.2	4268	68.8
	Semi-Detached	70	1.1	57	0.9	2	0.03	129	2.1
	Apartment	1014	16.3	325	5.2	2	0.03	1341	21.6
	Rural Route Residence	39	0.6	42	0.7			81	1.3
	Unit in Building	75	1.2	110	1.8			185	3.0
	Suite in Building	84	1.4	116	1.9			200	3.2
	Post Office Box Number	2	0.03					2	.03
	TOTAL	3034	48.9	3156	50.9	16	0.3	6206	100

On the basis of Table 3.2, house types 4 and 7 were also dismissed because of the difficulty in determining the location of rural addresses for interview purposes and insignificant numbers in the population. Living accommodation class 3 was also dismissed because of the low numbers in the population. This reduced the population size to 4582. The revised population was crosstabulated by house type and living accommodation and is shown in Table 3.3.

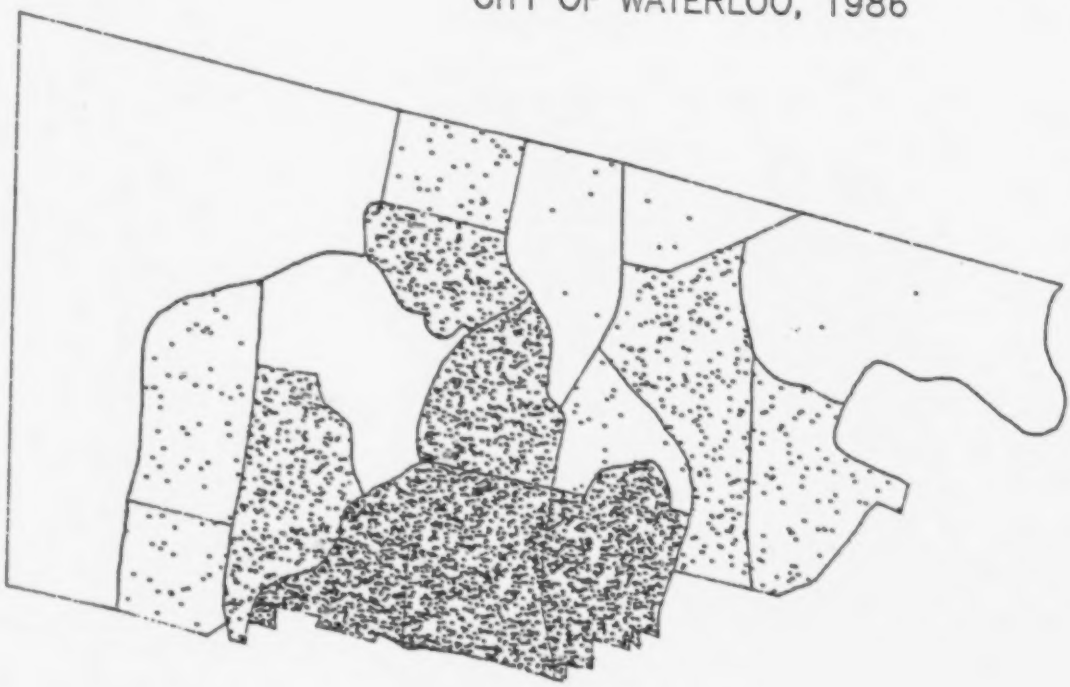
A visual comparison of the location variable may be assessed by comparing the revised population (Figure 3.2) with the original population (Figure 3.1) identified as points (addresses) distributed across MPDs. Clearly, the exclusion of house type 3 has the effect of thinning areas where elderly live in high density apartment residences. Despite this major difference, the two distributions are not overly dissimilar, either spatially or numerically.

TABLE 3.3

Revised Crosstabulation of Elderly Population by House Type of Residence and Accommodation Status

		Accommodation Status					
		Living Alone		Married Couple		Total	
		n	%	n	%	n	%
HOUSE TYPE	Detached	1750	38.2	2506	54.7	4256	92.9
	Semi-Detached House	70	1.5	57	1.2	127	2.8
	Unit Segregated Building	84	1.8	116	2.5	200	4.4
	Total	1904	41.5	2679	58.5	4538	100

FIGURE 3.2: [1] SPATIAL DISTRIBUTION OF REVISED ELDERLY POPULATION BY MAJOR PLANNING DISTRICTS CITY OF WATERLOO, 1986



[1] n=4583

NOTE: one dot equals one elderly occupied dwelling

FIGURE 3.3: [1] SPATIAL DISTRIBUTION OF ELDERLY SAMPLE STRATIFIED BY HOUSE TYPE AND ACCOMODATION STATUS CITY OF WATERLOO, 1986

[1] n=667

NOTE: one dot equals one elderly occupied dwelling

A proportionate random sample of 15% was selected from addresses comprising each cell of Table 3.3 using a computer-based random number generator. This produced a sample of 667 elderly distributed spatially and numerically as shown in Figure 3.3 and Table 3.4 respectively. The sample size of 667 comprised a 15% goal sample of 450 individuals (of a population of 4582) plus an additional 217 'backup' addresses. The latter number is high in relation to the former because the source list used was compiled in 1984, and some elderly may have moved or possibly died during the intervening two years. Also, if any subject visited was not that suggested on the address list, their address was discarded and a backup used in its place. The same procedure was followed for individuals not interested in participating or those individuals unable to be contacted after repeated visits during the three weeks allocated to the survey.

TABLE 3.4

Sample Distribution by House Type of Residence and Accommodation Status

		Accommodation Status					
		Living Alone		Married Couple		Total	
		n	%	n	%	n	%
HOUSE TYPE	Detached Dwelling	268	39.9	357	53.5	623	93.4
	Semi-Detached Dwelling	10	1.5	8	1.2	18	2.7
	Unit	11	1.6	15	2.2	26	3.9
	Total	287	4.3	380	5.7	667	100

3.2 Survey Response

During the three weeks of interviewing, it was discovered that a surprisingly large number of respondents were not interested in participating in the survey. In fact 223 (33.4%) sampled respondents were not interested in being interviewed. Additionally, 173 respondents (29.9%) were not home after repeated visits and six respondents (0.9%) sampled had died since 1984.

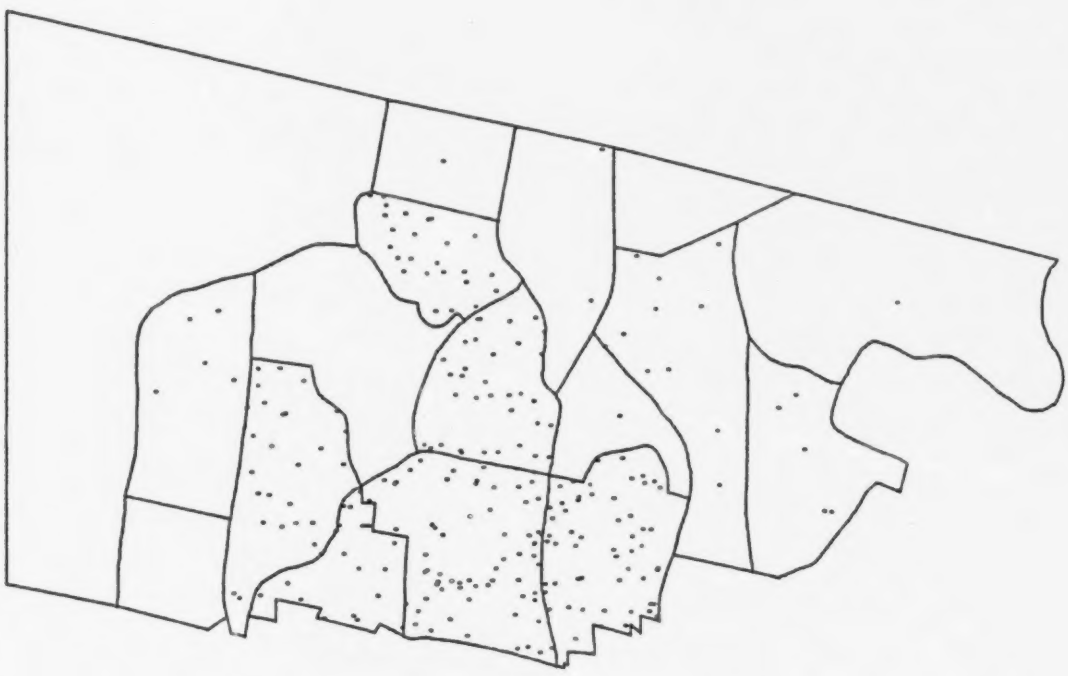
In view of the large number of failed interviews, it was decided half way through the interview period to aim for a 50% response rate of the original goal of 450 interviews. This was achieved with 256 completed interviews assembled for the subsequent analysis. In total, 93 interviews were completed from the backup address list and 173 were completed from the original sample. The success rates disaggregated by house type and living accommodation are shown in Table 3.5. The overall success rates are 38.4% of the total sample (667) and 56.9% of the goal sample (450). The spatial distribution of completed interviews is shown in Figure 3.4.

TABLE 3.5

Success Rates and Number of Successful Interviews
by House Type and Acommodation Status

		Accommodation Status					
		Living Alone		Married Couple		Total	
		n	%	n	%	n	%
HOUSE TYPE	Detached Dwelling	118	46.1	126	49.2	244	95.3
	Semi-Detached Dwelling	4	1.6	1	.40	5	2.0
	Unit	4	1.6	3	1.1	7	2.7
	Total	126	49.3	130	50.7	256	100

FIGURE 3.4: [1] SPATIAL DISTRIBUTION OF COMPLETED INTERVIEWS OF ELDERLY CITY OF WATERLOO, 1986



[1] n=256

NOTE: one dot equals one elderly occupied dwelling

Overall, the response to the survey is lower than anticipated, however, the coverage is considered good enough to allow informed statements to be made about winter home heating consumption and costs faced by the elderly.

In order to compare the elderly subgroup to the population at large, the residence next door to every twentieth completed elderly interview was also interviewed and home heating cost data for last winter were obtained. This rendered a data set of twenty-seven completed non-elderly households as a control sample with house type also controlled for. The spatial distribution of the control sample is such that at least one non-elderly resident was interviewed in MPDs corresponding proportionately with the spatial distribution of the elderly sample.

3.3 Survey Procedure and Questionnaire Design

In order to obtain information about winter home heating, a survey was conducted among the subjects identified by the sample procedure. The survey was administered by approaching the subjects at their place of residence and administering a questionnaire instrument in person. Interviews took twenty minutes to one half-hour to complete.

The questionnaire was divided into four sections (copies are available from the authors upon request). The first section obtained information about the physical aspects of the subject's home. These aspects included the type of house they lived in, whether the house was insulated and if so, when the insulation was installed, where it was and what type it was. Also, the type of heating system used was identified. Obtaining this information provided the study with some insight into the housing and home heating characteristics maintained by the sample group. With this information in hand, the study could also identify groups with common characteristics for subsequent data analysis.

The next section of the questionnaire was designed to elicit information about selected costs incurred by the elderly in maintaining

their homes during the winter months. This included data on their monthly heating bills from November to April, their monthly rent or mortgage payments, as well as the amount of money spent on maintaining a fireplace (if one was used to heat their home). Obtaining this cost data provided values for the first variable for calculation of a basic cost-income ratio, specific to the elderly. The next section of the questionnaire provided the information required to complete this ratio. In particular, questions were directed toward obtaining both the amount and the sources of household income. The study was interested in the total 'household' income because heating costs are incurred by the entire household. The study wanted to consider the household as a unit and to avoid examining individual household members. Furthermore, the study was also interested in matching the total household income against the total household heating costs to determine the relationship between these variables.

Included as sources of income were the number of government programs which are specifically available to the elderly. By having the subjects identify which of these programs they were receiving income from, the study was able to determine the amount of assistance the elderly receive from government programs as well as other sources of their income. This information provided insight into the elderly's involvement with subsidy programs as well as identifying the financial needs.

The final section of the questionnaire comprised a set of attitudinal questions. Ten questions were asked in order to obtain information on how the subjects felt about their heating costs. Some of these questions were dispersed throughout the instrument whereas the remainder were asked at its close. Although this data is somewhat subjective, it does provide information about subjects' feelings toward the amount of money they spend on heating their homes.

4.0 DATA ANALYSIS

The objective of this Chapter is to determine the home heating characteristics of the independent elderly population and to establish

whether or not the cost of home heating in relation to income constitutes a major problem for this group. To this end the analyses presented are organized around six areas of interest, namely, the locational and socio-demographic characteristics of the elderly sample; the dwelling, winter home heating systems and occupancy characteristics of the elderly sample; the cost of winter home heating to income ratio of the elderly sample; variations in the heating cost to income ratio among the elderly; the winter home heating cost to income ratio of the control sample; and variations in the heating cost to income ratio between the elderly and control samples.

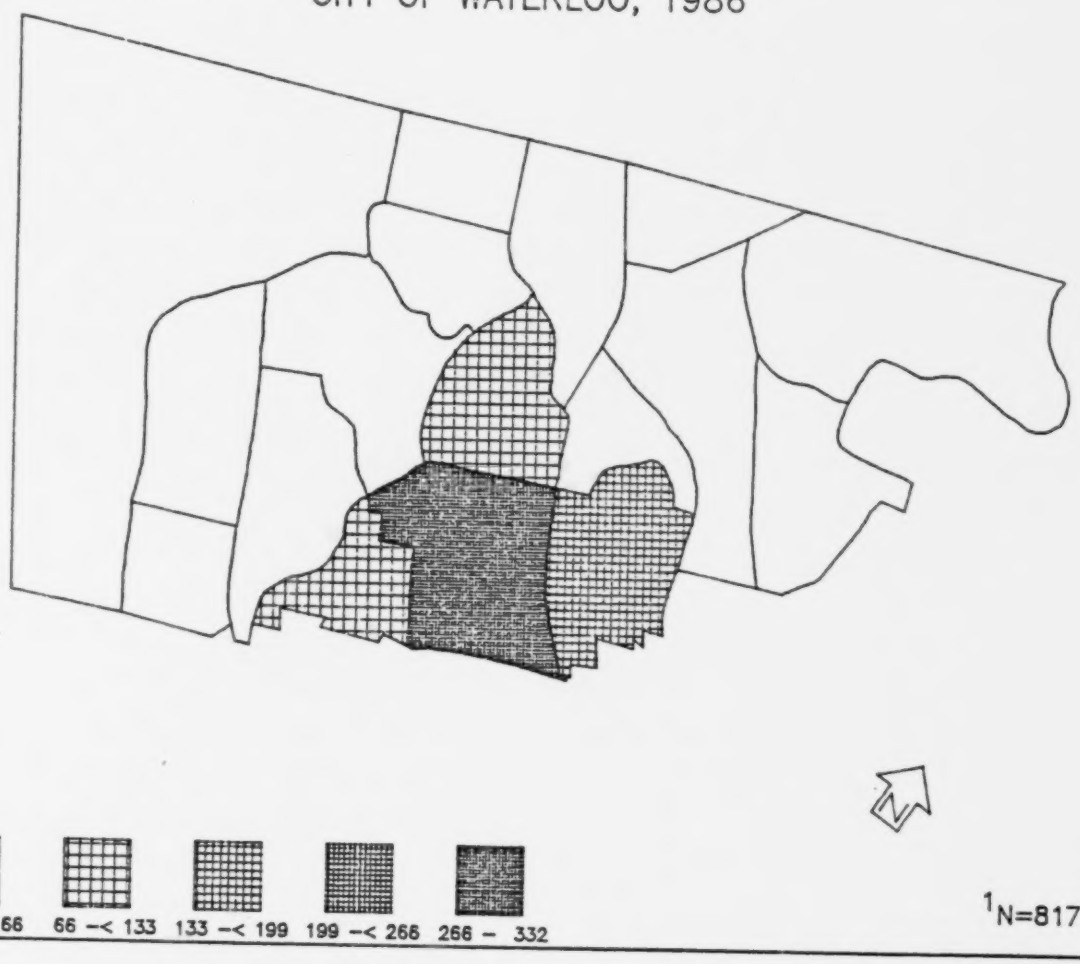
4.1 Locational and Socio-Demographic Characteristics of the Elderly Sample

As a preliminary to examining the socio-demographic characteristics of the sample, it is pertinent to consider the location of the elderly population in Waterloo. Research literature suggests that the elderly are spatially congregated in or around areas adjacent to the central business districts of cities. These places are characteristically where the oldest housing is located,[23] and, as noted earlier, populations "age in place" along with the areas and residences they occupy, unless a process of continual replacement of younger households in successively older dwellings occurs. The City of Waterloo appears to be no exception to this regularity. Figures 4.1 through 4.3 demonstrate an increasingly constrained geographic distribution of elderly by MPDs, from a relatively dispersed young elderly (60-64 years) population (Figure 4.1), through an older elderly (75-79 years) population (Figure 4.2), to an older elderly (80 years plus) population (Figure 4.3). It is noteworthy that all three age groups are most numerous in the central business district MPD and that the numerical size of successive age groups decreases, as expected. There is, therefore, clear evidence in support of Hypothesis 1 for the City of Waterloo. The older elderly are indeed concentrated in the older dwellings located in and around the central business district.

FIGURE 4.1: SPATIAL DISTRIBUTION OF ELDERLY POPULATION BETWEEN 60 AND 64 YEARS OF AGE CITY OF WATERLOO, 1986 [1]

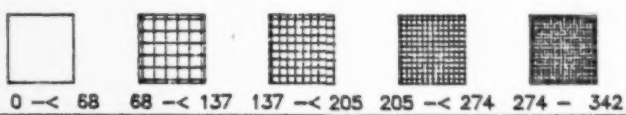
[1] N=1985

FIGURE 4.2: SPATIAL DISTRIBUTION OF ELDERLY POPULATION BETWEEN 75 AND 79 YEARS OF AGE[1] CITY OF WATERLOO, 1986



[1] N=817

FIGURE 4.3: SPATIAL DISTRIBUTION OF ELDERLY POPULATION 80 YEARS PLUS [1] CITY OF WATERLOO, 1986



[1] N=707

In addition to the characteristic locational pattern of the elderly population, they are also differentiated from the non-elderly in several other important respects; specifically, elderly households are typically in the post-child rearing stage of the family life-cycle and this should be reflected in household size. This expectation is confirmed by inspection of Tables 4.1 and 4.2 which contain information describing household size for the elderly and control samples respectively. Whereas the elderly sample has a modal household size of two persons, a relatively large proportion of single person households (21.5%) and a very small proportion of large, family-oriented household's (0.05%), the control sample is trimodal with two, three, and five person households most numerous. Also, notably, the control sample has no single person households. Thus Hypothesis 2 is confirmed by the data.

Most of the literature examining the demography of aging suggests that, with increasing age, females, either single (unmarried) or widowed, increasingly outnumber males in the population. Moreover, the literature discussed in Chapter 2.0 suggests that elderly households headed by either widowed or spinster females have general difficulties in meeting living costs at or above the poverty level. The sex, residency status and age of the elderly sample is therefore of considerable interest in the present study.

Analyses of the data show that single, female renters or homeowners constitute 10.5% (24) of the elderly sample. This proportion is considerably lower than the 33% suggested by Gunn.[24] Yet, when extrapolated to the elderly population of Waterloo, the numerical size of this group is not trivial.

Comparison of the age and sex distributions of the elderly who live alone with those who live in multiple person households, reveals several interesting trends (Tables 4.3 and 4.4 respectively). For example, the overall sex ratio is equal for elderly who live alone; while males outnumber females in the 60-69 age groups, the reverse is true in the 70 and above age groups, with 75-79 year old male and females equally

TABLE 4.1

Numbers of Persons in Household - Elderly Sample

	Number	Percent
One	49	21.5
Two	151	66.2
Three	22	9.6
Four	5	2.2
Five	1	.05
Total	228	100

Missing cases 28

TABLE 4.2

Number of Persons in Household - Control Sample

	Number	Percent
One	0	0
Two	7	26.9
Three	7	26.9
Four	4	15.4
Five	8	30.8
Total	26	100

Missing cases 1

TABLE 4.3

Cross Tabulation of Age Group by Sex:
Elderly Who Live Alone

	Male	Female	Total
	n	n	n
60-64	6	2	8
65-69	5	3	8
70-74	4	7	11
75-79	7	6	13
80+	3	6	9
Total	25	24	49

TABLE 4.4

Crosstabulation Age Group by Sex
Multiple Person Households - Elderly Sample[1]

	Male	Female	Total
	n	n	n
60-64	54	74	128
65-69	53	51	104
70-74	30	23	53
75-79	13	12	25
80+	6	3	9
Total	156	163	319

[1] This includes only individuals aged sixty and above living together.

represented (Table 4.3). For those in multiple person households, the trend is less clear cut. The overall sex ratio is, again, approximately equal, although males outnumber females in all age groups with the exception of the 60-64 age group which is heavily biased toward females (Table 4.4). Chi-square tests conducted at the 95% confidence level (df=4) for Tables 4.3 and 4.4 could not allow rejection of **Hypotheses 4** and **6**. Moreover, there is insufficient evidence to accept **Hypothesis 3**, and **Hypothesis 5** has at best, only a modicum of support.

In summary, therefore, while the elderly of Waterloo exhibit similar locational trends to elderly elsewhere, the sample does not exhibit clearly the demographic composition anticipated for this population group. Males and females are approximately equally represented at all age groups and this does not differ according to residency status. Additional tests proved this observation to hold also for size of house and type of house.

4.2. Dwelling Characteristics, Occupancy Characteristics and Home Heating Systems of the Elderly Sample

Based upon the "aging in place" hypothesis, there should be evidence of a positive correlation between the age of dwellings and the age of their household heads. This association is confirmed in the present study with a Pearson correlation of 0.2078 ($p<.001$, 1 tailed test) for all dwellings ($n=226$). While the correlation is not as strong as might be expected, it is nonetheless in the correct direction and statistically significant. Thus, hypothesis seven is confirmed. When disaggregated by house type, the relationship between dwelling age and age of resident is consistent for detached dwellings ($r=0.1744$, $p<0.01$, $n=219$) and semi-detached dwellings and townhouses aggregated together ($r=0.7841$, $p<0.01$, $n=9$). **Hypothesis 8** is also, therefore confirmed.

Taken independently these relationships tend to subscribe to the scenario described in Chapter 2.0 where older residents reside in older dwellings which are presumed to be less heat efficient than newer

dwellings. This scenario is, however, shown to be somewhat misleading when two further statistics are considered. First, the mean age of all dwellings in the elderly sample is 33.66 years, with a fairly large standard deviation of 21.3 years. The mean age of respondents is 68.21 years with a much smaller standard deviation of 6.7 years. Dwellings are therefore on average only half the age of their residents and houses built in the early 1950s, while not new, are certainly far from old. The second and more revealing statistic is a first order partial correlation between age of dwelling and age of heating system, controlling for age of resident. If the scenario of older resident, older house, older heating system, less heat efficiency is accurate, the partial should be positive. In fact the first order partial is negative and highly significant ($r=0.5751$, $p<0.001$, $n=225$). Older houses, therefore, despite their generally older residents, tend to have newer heating systems with, presumably, higher energy efficiency than those they replaced. On this basis, **Hypothesis 9** is rejected.

Overwhelmingly, the sampled elderly own their homes (Table 4.5) and less than ten per cent of homeowners have current mortgages. Hence, both parts of **Hypothesis 10** are confirmed. This indicates that only 12.3% (25) of the elderly sample have shelter costs over and above energy costs, insurance, property tax and maintenance.

A further consideration leading towards the cost of winter home heating in relation to household income is the building materials used in the construction of dwellings. Analysis of the relationship between construction material and dwelling age revealed no significant difference (chi-square=22.11, df=15, $p>0.05$) with brick the modal material (86.8% of all dwellings). There is, therefore, no evidence that older houses are built from different materials to newer houses and **Hypothesis 11** cannot be rejected.

An argument frequently encountered in the elderly housing literature suggests that elderly households often occupy houses which have become larger than their space needs warrant with the departure of siblings.

TABLE 4.5

Tenure of Homes and Number of Mortgage Holders -Elderly Sample[1]

	n	Mortgage Owing	No Mortgage
Rent	6 (2.6)	/	/
Own	222 (97.4)	19 (8.6)	203 (91.4)
Total	228 (100%)	19	203

[1] excludes 28 missing cases

TABLE 4.6

Number of Bedrooms by Number of Bedrooms Occupied, Elderly Sample[1]

		Number of Bedrooms Occupied Last Winter				
		1	2	3	4	TOTAL
Number of Bedrooms	2	19	10			29
	3	64	61	14		139
	4	11	13	17	6	47
	5	1	5	3	1	10
	6	1		1	1	3
	Total	96	89	35	8	228

[1] excludes 28 missing cases

$x^2 = 63.18$ df = 12 p = <.001

Thus, in terms of winter home heating either unused areas of houses are being kept warm during the winter at a higher cost or these areas are being closed off. In either context, such use of space is non-optimal.

The existence of unused space in dwellings occupied by the elderly residents sampled in the present study is examined in terms of the total number of bedrooms per dwelling by the number of bedrooms occupied last winter. The result for the elderly sample is contained in Table 4.6. Inspection of the table reveals that only 13.2% (30) of all the dwellings in the survey had bedrooms that were fully occupied last winter. One hundred and twenty five of the one hundred and thirty nine three bedroom dwellings had only one or two bedrooms occupied. And in thirteen dwellings with between four and six bedrooms, only one bedroom was occupied last winter. Thus, chi-square, is significant at the 99.9% confidence level and the null hypothesis of no difference between the number of bedrooms and number occupied last winter is convincingly rejected. There is clear evidence of unused space in elderly households and **Hypothesis** 12 is accepted. Prior to consideration of actual winter home heating costs among the elderly sample, trends in home heating systems, dwelling age and number of bedrooms occupied are now discussed.

This section has established that older houses do not necessarily have older heating systems, a result which is confirmed also by Table 4.7. From this Table it is clear that forced air oil and forced air gas are the main home heating systems used, with respectively seventy-five and one hundred and thirty dwellings using these forms of heating supply. Closer inspection of Table 4.7 reveals that older houses with fewer bedrooms occupied, use either forced air, oil or gravity fed oil. Conversely, newer homes with more bedrooms occupied, use forced air gas. Intuitively, this contingency distribution makes good sense, given the proven cost-efficiency of forced air gas heating systems.

The suggestion implied in much of the elderly housing literature that the elderly are too financially constrained to undertake capital intensive home improvements thus loses further credibility when considered in the

TABLE 4.7

Dwelling Age, Home Heating System and Number of Bedrooms Occupied

Heating System

	No. Occupied Bedrooms	Forced Air Oil					Forced Air Gas					Forced Water					Gravity Fed Gas					Gravity Fed Oil					Electricity					Wood					SUBTOTAL
		1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	
Dwelling Age	1		2			2	5	6	3	1	15																					3				3	20
	2	3	8			11	18	19	9	2	48	1		1		2											1	1			2		1			1	64
	3	12	7	2		21	17	13	3	2	35							1			1		1			1								1		1	59
	4	7	6	5		18	8	5	3		16												1			1	1				1		1			1	37
	5	4	5	1		10	2	3	2		7												2			2		1			1						20
	6	5	4	3	1	13	5	2		2	9			1		1	1				1	2	1	1		4											28
Sub Total		31	32	11	1	75	55	48	20	7	130	1		2		3	1	1			2	3	4	1		8	2	2			2	3	2	1		6	228

context of Table 4.7. Individual contingency tests of the distributions in Table 4.7 by the number of bedrooms occupied produced only one significant statistic, for dwellings with a single bedroom occupied last winter (chi-square=66.45, df=30, $p<.001$). In all other cases the null hypothesis of no difference in heating system type by age of house could not be rejected.

Thus, old houses are equally likely to have the same type of heating system as newer houses independent of number of bedrooms occupied, with the exception of dwellings with one bedroom used last winter. In the later case, forced air gas is more likely to be found in newer dwellings. **Hypothesis 13** can therefore only be rejected in one case; in all other cases there is insufficient evidence to reject the hypothesis.

Substitution of age of dwelling with age of respondent (Table 4.8) makes little difference to the result discussed above. This is to be expected, given the proven association between age of respondent and age of dwelling. Of the individual contingency distributions contributing to Table 4.8, the only one to prove statistically significant was for dwellings with three bedrooms occupied. In this case, younger elderly in the 60-64 age group are more likely to have forced air gas than expected under the null relationship expressed in **Hypothesis 14**. In all other cases there is no significant difference in heating system used by age of respondent, controlling for number of bedrooms used last winter.

Cumulatively, the results presented provide a useful backdrop for investigation of winter home heating cost and income, which is now considered.

4.3 The Cost of Winter Home Heating and Income Among the Independent Elderly

Many factors relating to the household and the dwelling affect the quantity, and therefore the cost of winter home heat consumption. In this section the cost of heating and its ratio to income is considered independently of any explanatory variables. This serves as an introduction

TABLE 4.8

Age of Respondent, Home Heating System and Number of Bedrooms Occupied

Heating System

	No. Occupied Bedrooms	Forced Air Oil					Forced Air Gas					Forced Water					Gravity Fed Gas					Gravity Fed Oil					Electricity					Wood					
		1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	1	2	3	4	ST	SUBTOTAL
Age of Respondent	60-65	7	11	5		28	19	15	17	1	53	1		1		2								1		1	1	2			3	1	1			2	84
	65-69	5	5	4		14	16	22	2	2	42							1				1	2			2	1				1	2				2	62
	70-74	8	9		1	18	8	4	1	3	16			1		1	1					1	1	1		2							1	1		2	40
	75-79	9	5	2		16	6	4			10												2			2											28
	80+	2	2			4	6	3			9													1		1											14
Subtotal		31	32	11	1	75	55	48	20	7	130	1		2		3		1	1			2	3	4	1	8	2	2			4	3	2	1		6	228

to the more complex task of explanation and also as a useful yardstick by which to gauge the extent of the problem of winter home heating for the population sub-group under consideration.

In a recent report the Ontario average cost of home space heat for the winter of 1985 was stated as $776.00.[25] In the total sample (elderly plus control) analyzed in the present study, seventy two households of 252 with valid data (28.57%) spent more than the Ontario average in space heat last winter; 46 (18.25%) spent more than $900.00, and 30 (11.9%) spent more than $1000.00 to heat their homes. The mean cost was $717.90 with a minimum of $243.00 and a maximum of $1560.00. While this result is insufficient to reject **Hypothesis 15**, it does indicate almost thirty per cent of all households surveyed have higher than average winter space heating costs.

Separation of the elderly sample from the overall sample does not affect significantly the proportions reported above; all three statistics increase by one percentage point. Thus, **Hypothesis 16** is not supported by the data. However, it must be remembered that heating cost is only one side of the affordability ratio. With the inclusion of income the ramifications of higher than average home heating costs become acute, especially for those faced with inordinately high and inflationary costs, juxtaposed against fixed or only slowly increasing incomes. Furthermore, the fact that thirty per cent of the elderly sample spent more than the Ontario average on home heating last winter, hints at the existence of an affordability problem.

Inspection of the ratio of winter home heating cost to household income for the whole sample reveals that the magnitude of the anticipated affordability problem is much smaller than expected. Overall, 26.9% of the sample (elderly and control) spent more than one dollar in ten dollars of income on home heating last winter; correspondingly, 73.1% spent less than one dollar in ten of income. The mean cost to income ratio was $1:$19.10 with a minimum of $1:$2.29 and a maximum of $1:$68.63. Cumulatively, these results support **Hypothesis 17** and suggest that winter home heating cost does not pose a major affordability problem to the majority of the sample.

Literature discussed in Chapter 2.0 indicates that all housing costs consume fifty per cent of the income of the majority of elderly, and winter home heating costs consume fifty per cent of housing costs. This suggests that the elderly, in general, spend one dollar in every four earned during the winter on home heating. Investigation of this proposition with the present data set shows this not to be the case. In fact 70.83% of the elderly spend less than one dollar in ten of income on winter home heating. Of the 29.17% who spent more than a tenth of their winter income on staying warm, eight individuals (1.85% overall) spent more than $1.00 in $5.00 earned and only four spent twenty-five per cent ($1:$4) of their winter income on home heat. Given these results **Hypothesis** 18 is resoundingly rejected and in general the elderly in Waterloo appear to be financially well equipped to meet the costs of winter home heating comfort.

Clearly, however, generalizations may disguise the existence of subgroups of elderly who are systematically more disadvantaged than the others. This possibility is now investigated in more detail.

4.4 Variations in the Cost of Winter Home Heating to Household Income Ratio Among the Elderly

This section proceeds by examining several sets of relationships: first, the difference in heating costs between renters, mortgage holders and the majority of elderly who own their homes mortgage-free; second, differences in the ratio of home **operating** costs (heat plus mortgage or rent) to household income are assessed for the same subgroups; and third, characteristics of individual elderly who either have difficulties or do not have difficulty meeting heating costs are considered. The section is concluded with an examination of several further explanatory variables.

Inspection of Table 4.9 reveals that the differences in mean heating costs between the three groups mentioned above are not statistically significant. Analysis of mean heating costs between pairs of groups using Student's t-test also proved fruitless in that no individual null

TABLE 4.9

Difference in Cost of Winter Home Heating:
Mortgage Holders, Renters and Residual Elderly[1]

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	31178.8230	15589.4115	.4201	.6575
Within Groups	213	7904259.010	37109.1972		
Total	215	7935437.833			

Groups	n	mean	Standard Deviation	Standard Error	Minimum	Maximum
Mortagage Holders	18	708.67	142.37	33.56	484.00	1038.00
Renters	4	612.00	329.14	164.58	369.00	1098.00
Mortgage and Rent Free	194	696.03	193.61	13.90	243.00	1230.00
Total	216	696.03	192.12	13.07	243.00	1230.00

[1] Excludes 40 cases with missing data.

hypothesis could be rejected. Thus **Hypothesis 19** is accepted and heat costs do not differ according to tenure status between elderly subgroups.

When household income and mortgage or rent costs are introduced into the analysis the result is, however, very different (Table 4.10). The mean ratio of home **operating** costs (rent or mortgage plus heat) to income differ significantly between groups and **Hypothesis 20** is rejected beyond the 99.99% confidence level. In order of increasing affordability, house renters pay on average $1.00 in every $4.17 earned on home operating costs, mortgage holders pay $1.00 in every $6.65 earned and the residual (majority) elderly pay on average only $1.00 in $17.97 earned. Addressed in these terms, elderly home renters coincide with the ratios suggested in the literature and those with unpaid mortgages also appear to be in general difficulty in terms of operating costs vis-a-vis their household income. Tenure status is therefore an important explanatory variable in identifying elderly sub-group in who may need public sector support.

With the data collected it is possible to describe individual subgroups of elderly based upon their heat to income ratio. Those who spent one dollar in thirty or less of household income (n=33) on heat last winter typically live in multiple person households (31); had a mean household income in 1985 of $45,450.82; own their homes mortgage-free (31); are relatively young elderly (mean age=63.57 years); live in relatively new housing (mean age=23.81 years); are still working (23); were born either in Ontario (12) or somewhere else in Canada (9); have more than one income earner (16); and predominantly have forced air gas furnaces(23). All but one of this group intend to stay in their present home and surprisingly, three with heat cost to income ratios of $1:$34.72, $1:$40.37, and $1:$60.34, report difficulties in meeting winter home heating costs. The descriptive is, therefore, of a young and relatively affluent elderly subgroup.

Conversely, those who pay a much higher proportion of their household income on staying warm during the winter have quite different characteristics. In particular, those with a heat cost to income ratio of

TABLE 4.10

Differences in Ratio of Heat Costs to Income: Renters, Mortgage Holders and Residual Elderly[1]

ANALYSIS OF VARIANCE

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Probability
Between Groups	2	2748.6040	1374.3020	10.0452	.0001
Within Groups	213	29141.0151	136.8123		
Total	215	31889.6192			

Groups	n	mean	Standard Deviation	Standard Error	Minimum	Maximum
Renters	4	4.17	1.32	.66	2.79	5.50
Mortgage Holders	18	6.68	4.08	.96	2.10	18.40
Mortgage and Rent Free	194	17.97	12.23	.88	2.29	68.63
Total	216	16.78	12.18	.83	2.10	68.63

[1] Excludes 40 cases with missing data.

at least one dollar in every six dollars of income earned (n=14) predominately live alone (10); had a low household income in 1985 (mean=$10,195.71); live in houses on average twice as old as their counterparts (mean=46.64 years); are generally older (mean age=74.1 years); are retired (14) living predominately on pensions (11) with no income earner in the household (9). Half of this group (7) report difficulty meeting winter home heating costs and fortunately all are mortgage-free homeowners. Clearly, if any individual in this group were a renter or a mortgagee they would be in dire financial straits. There is, therefore, a clear divergence in the type of elderly household struggling with the cost of winter home heating and those who are trouble-free. Thus, **Hypothesis 21** is supported by the data.

A point worth considering here is that heating costs will either remain constant, or more realistically, increase in the future. The young elderly, who will soon become more numerous than the old elderly, will be faced with smaller incomes after retirement from the active workforce. It is likely, therefore, that in the future a transference from group one above to group two will occur and those faced with home heating difficulties will be more numerous than at present.

A further factor presumed to affect the ratio of heat costs to income includes the presence or absence and comprehensiveness of insulation in the home. This expectation is investigated in Table 4.11. The difference in the mean heat to income ratios for those with and without insulation in their basement and walls are statistically significant at the 92% and 99% confidence levels respectively. In both cases, those households with insulation have significantly lower heat to income ratios than those households without insulation in those places. The small number of households (5) without roof insulation renders the statistic for this location uninterpretable. In fact the same respondents (5) had neither basement nor wall insulation and, incongruously, their heat to income ratio is lower than those with insulation in at least one location. Hence, **Hypothesis 22** (i) cannot be rejected and (ii) can be partially rejected by the data.

TABLE 4.11

Location of Insulation in the Home and Ratio of Heat Costs to Household Income - Elderly Sample[1]

Location of Insulation		n	mean	Standard Error	F	Probability	t-value	Probability
Basement	Yes	32	21.45	2.68	1.85	.015	1.75 (207)[2]	.082
	No	177	17.47	.84				
Roof	Yes	211	17.99	.83	1.30	.908	-.36 (214)[2]	.705
	No	5	19.92	4.71				
Walls	Yes	150	20.00	1.04	2.20	.000	4.36 (214)[2]	.000
	No	166	13.54	1.05				

1 t-tests for basement and walls use a separate variance estimate; roof uses a pool variance estimate.

2 Degrees of Freedom.

The evidence presented in this section refines the analysis substantially. Clearly, the elderly do not constitute a homogeneous group and while the general impression gained is that heat costs are not problematic, there is, nonetheless, a sizeable minority of elderly with specific characteristics who cannot easily afford heat derived comfort in the winter. Only passing mention has been made to date of the home heating affordability of the non-elderly population. This is assessed in relation to the elderly subgroup in the following section.

4.5 Variations in the Home Heating Cost to Household Income Ratio Between the Elderly and Control Samples

As an initial comparison, the mean cost of winter home heating to the control sample (n=27) in 1985 was $698.36 and the mean ratio of heating cost to household income was $1.00:$29.62. Both figures are substantially lower than the elderly sample. Prior to examining the statistical significance of these differences the control and elderly samples are compared across three descriptive variables, namely age of house, size of house, and 1985 household income. In Table 4.12 dwelling age is shown not to differ significantly between the elderly and control samples, confirming **Hypothesis 23**. Also in Table 4.12, mean family income of the control sample is shown to be substantially higher (almost by 100%) than mean elderly household income. Consequently, **Hypothesis 24** is rejected beyond the 99.9% confidence level.

In the research design for the study discussed in Chapter 3.0, it stated that the control sample was selected specifically to control for house type and size, while serving as a comparison for the elderly. Control subjects in every instance lived next door to an elderly subject. Yet the contingency distribution in Table 4.13 indicates that house size differs somewhat between the samples with the elderly living in smaller houses. However, the differences in house size are not statistically significant at the 95% confidence level between the two groups. Thus, **Hypothesis 25** cannot be rejected and there is no significant difference in house size between the elderly and control samples.

TABLE 4.12

Age of House and Household Income Differences
- Elderly and Control Samples[1]

Variable		n	mean	Standard Error	F	Probability	t-value	Probability
Age of House	Control	25	34.44	4.07	1.09	.840	.18 (251)[2]	.859
	Elderly	228	33.66	1.41				
Household Income	Control	23	41043.48	3245.23	1.37	.263	5.87 (238)[2]	.000
	Elderly	217	23648.28	902.76				

1 All t-tests are 2 tailed pooled variance estimates.

2 Degrees of Freedom.

TABLE 4.13

Size of House by Elderly and Control Samples

	1 Story	1½ Story	2 Story	2½ Story	3 Story	TOTAL
Control Sample	3	10	9	21	3	27
Elderly Sample	94	66	72	4	1	256
TOTAL	97	76	81	25	4	283

Chi Square = 8.37 df = 4 p = .078

Since house size and type are generally equivalent between the two sample groups, the expectation, stated in **Hypothesis 26**, is that mean winter heating cost will not vary significantly. This is supported by the result in Table 4.14 where the null hypothesis of no difference cannot be rejected. It is apparent, however, from Table 4.14 that the elderly do spend more, on average, than the control on home heating. This is relatively easily explained in that the older elderly, who spend more time indoors during the winter, require a more balanced daily consumption of heat than either the young elderly, or certainly, the non-elderly.

This observation is supported by the results in Table 4.15, where there is no significant difference in the mean night-time thermostat setting between the elderly and control samples, contrasted against a highly significant mean day-time thermostat setting. Whereas the control spend relatively less time in the house during the winter days and thus consume less heat, the elderly, who are, in general more home bound, maintain significantly higher day-time temperatures inside their homes. **Hypothesis 27** is therefore rejected for night-time temperature setting but not for day-time temperatures.

Evidence has been presented which shows the elderly, on average, earn less than the non-elderly, consume more home heat during the winter, and spend more on it. Together these findings suggest that the ratio of heat cost to household income will be quite different for the two sample groups. This expectation is tested by **Hypotheses 28** and **29**.

Heat costs in relation to household income are tested on a monthly basis, from November to April, in Table 4.16. The results show conclusively that there is a highly significant difference between the elderly and the control samples for all six months, with the elderly spending significantly more of their lower incomes on home heat. Inspection of differences between the monthly means reveals that the months of November and March, at the start and end of the winter respectively, have the largest difference between the ratios of the two groups ($12.53 and $12.64). At these two end points the sensitivity of the elderly to

TABLE 4.14

Difference in Winter Home Heating Cost
- Elderly and Control Samples

	n	mean	Standard Error	F	Probability	t-value	Probability
Control Sample	25	698.36	45.64	1.05	.950	-.45 (250)	.659
Elderly Sample	227	720.05	15.49				

TABLE 4.15

Differences in Day and Night Time Thermostat Settings
- Elderly and Control Samples

		n	Mean	Standard Error	F	Probability	T-value	Probability
Daytime Setting	Control	25	19.28[1]	.30				
	Elderly	228	19.34[1]	.13	1.60	.169	-.15 (251)	.884
Nightime Setting	Control	25	18.92[1]	.88				
	Elderly	228	20.50[1]	.10	8.63	.000	-3.79 (251)	.000

1 Temperatures in Degrees Celcius

TABLE 4.16

Monthly Winter Home Heat to Income Ratio
- Elderly and Control Samples

Month	Group[1]	Mean	Standard Error	F	Probability	t-value	Probability
November	Control	34.01	11.26	1.85	.09	4.79	.000
	Elderly	21.48	15.30				
December	Control	30.76	1.87	1.83	.10	4.86	.000
	Elderly	18.12	.81				
January	Control	22.93	2.13	1.32	.47	4.41	.000
	Elderly	16.73	.78				
February	Control	27.56	2.19	1.35	.43	4.23	.000
	Elderly	16.44	.81				
March	Control	29.33	1.97	1.74	.14	5.25	.000
	Elderly	18.11	.83				
April	Control	33.01	2.05	2.51	.01	4.71	.000
	Elderly	22.20	1.03				

1 In all analyses control = 22 cases; elderly = 216 cases.

TABLE 4.17

Difference in Mean Cost of Winter Home Heat to Household Income
- Elderly and Control Samples

	n	Mean	Standard Error	F	Probability	t-value	Probability
Control Sample	22	29.62	1.90				
Elderly Sample	216	18.03	.81	1.80	.114	5.60 (236)	.000

colder temperatures is clearly shown. For both groups the mid-winter months of January and February cause the heat cost to income ratio to rise sharply to a high of $1:$16.44 in February for the elderly. Given these results Hypothesis 28 is supported strongly.

The penultimate hypothesis examined in this study contrasts the mean total ratio of heat to income costs between sample groups. All evidence points toward the elderly spending significantly more on home heat than their non-elderly counterparts. The result in Table 4.17 shows this convincingly to be the case. In fact the elderly spend, on average, one dollar in eleven dollars and fifty nine cents of income more on winter home heat than the non-elderly, controlling for house type and size. This result illustrates the large financial burden that relatively insignificant costs prior to retirement can cause after a household withdraws from the active workforce.

The ultimate hypothesis in this study is considered in the final Chapter, in which the results are summarized, policy recommendations are made and a path for future research is charted.

5.0 SUMMARY AND CONCLUSIONS

This study has examined the winter home heating cost to household income ratio for a sample of independent elderly residents in the city of Waterloo, Ontario. As a benchmark for comparison against variations in the cost of home heating among the elderly, the same data were collected for a control sample of non-elderly households, holding constant type, age and size of home. The general objective of the study was to determine whether or not the elderly are having sufficient difficulty meeting the costs of keeping warm during the winter to warrant either direct or indirect subsidization by the public sector. In fulfilling this objective the study has analyzed comprehensively variations in heating costs and explored some of the variables which underlie the observed variance. Two points of major importance emerge from the discussion.

First, in the context of **Hypothesis** 30, the study shows that it is not possible to accept or reject this hypothesis without considerable qualification. On the one hand the study shows, using the available literature as the only readily accessible guideline for a definition of affordability, that relatively few elderly have problems in meeting the costs of winter home heating. The cost to income data reported in chapter 4.0 is supported in this instance by the fact that only 48 (18.8%) of the elderly report difficulties in meeting energy costs. And several of these 48 subjects were shown to have inordinately low heat to income ratios. This data in combination with other evidence presented in sections 4.2 and 4.3, leads to a rejection of hypothesis thirty. On the other hand, however, evidence presented in section 4.4 cautions a retreat from outright rejection of hypothesis thirty.

This introduces the second point of major importance to emerge from the study. Despite the tendency in the literature to refer to 'the elderly' as a generic, homogeneous group, this study clearly shows that such generalizations are at best risky and at worst incorrect. In fact, the results in Chapter 4.0 indicate that it is imperative to differentiate between the young, intermediate and old elderly in terms of their needs and their ability to meet the essentials of an independent existence. Although all groups of elderly are eligible for and utilize essentially the same government programs (see Appendix) there is a clear variation in the financial burden placed upon discrete subgroups of the elderly population. In particular, mortgagees and renters are substantially disadvantaged in terms of their low net income after total housing costs are extracted. With the inclusion of property tax (despite the rebate for the elderly), insurance and home maintenance, the winter cash flow of elderly mortgage holders is very low indeed. It is under these circumstances when the deterioration spiral referred to in Chapter 2.0 is most likely to occur.

Hence, **Hypothesis** 30 should not be dismissed out of hand, based upon simple aggregate heat to income ratios and generalizations of the sort commonly encountered in the literature. The issue of whether the public sector should become involved with elderly households who rent or who have

not managed to pay off their mortgage is an ethical question that centres upon ideology and the prerogative of the welfare state. Ideological conservatives would presumably disapprove of a direct monetary subsidy to these individuals. Moreover, since the problem of this minority is shown, in this study, not to be with the cost of heat consumption per se but with heat consumption in relation to other housing costs and income, the strategy of home or heating system upgrading is clearly not worthwhile. Unfortunately, the likelihood of any improvements being made will depend upon the way in which current government sees its role in relation to the needs of the population it represents.

Given the relative complexity of the influences on the affordability of winter home heat for the elderly, it is no easy task to develop a policy position on the matter. The evidence presented suggests that, in simple terms, there is no immediate need for public sector relief in terms of financial subsidy or energy efficiency improvement for the young-independent elderly. However, for the older-elderly who have lower incomes and higher heating costs, and those who are mortgaged or who rent, there are grounds to argue for a means-tested winter home heating income supplement. The number of individuals found to have problems appears small in the context of the sample examined in this study. However, when extrapolated out to the elderly population at large, the number is by no means trivial.

Beyond the discussion and results presented in this study there is certainly scope for refinement of the research design and clear potential for examination of this issue in other cities with different demographic and income characteristics to the elderly residents of Waterloo. If similar research were undertaken in other Canadian cities with older housing stock and a large working class population, the results uncovered in this study would presumably be duplicated and, if anything, the magnitude of the affordability concerns found in Waterloo would be substantially magnified.

NOTES

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13. Gunn et al., Older Canadian Homeowners, 9.

14. Ibid, 70.

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APPENDIX

FEDERAL PROGRAMS

CANADA MORTGAGE AND HOUSING CORPORATION

(i) RESIDENTIAL REHABILITATION ASSISTANCE PROGRAM - RRAP

- established in 1974
- under National Housing Act (NHA), owners may get a loan of up to $10,000 to repair and upgrade their homes
- owners with incomes of less than $13,000 are forgiven $5,000 of the loan
- available universally to all homeowners to those who spend equal to, or greater than 30% of their income on shelter costs
- in Waterloo, income threshold level is $13,000 for one person occupancies, and $14,500 for two persons
- upgrade of the home includes necessary repairs to deficient levels of: structure, heating, plumbing, electricity or fire safety
- all measures of income are included to determine household income

HEALTH AND WELFARE CANADA

(i) OLD AGE SECURITY PENSION - OAS

- monthly pension to permanent residents aged 65
- must have lived in Canada 10 years
- amount: $288.34 per month
- goes up quarterly (with the cost of living)

(ii) CANADA PENSION PLAN - CPP

1986 Maximum Pensionable Earnings $25,800.00

1) Retirement Benefits:
   - eligibility: a) must have contributed to the pension plan
     b) must be 65 years of age
   - amount: 25% of current value of average monthly pensionable earnings
     - maximum $486.11 per month

2) Disability Benefits:
   - eligibility: a) must be less than 65 years of age
     b) must have contributed in at least 5 of last 10 years plus 2 additional years
     c) must be determined to be disabled within the meaning of CPP legislation

- amount: $91.06 per month plus 75% of current value of retirement pension
  - maximum $455.64 per month
  - dependents receive $91.06 per month

3) Survivor's Benefits:
- eligibility: a) deceased must have contributed one third years since 1966
  b) minimum of three years of contribution

a) Death Benefit - to the estate of the contributor
  - 6 times the current value of retirement pension but not exceed 10% of the year's maximum pensionable earnings ($2,580)

b) Spouses Pension- spouse of deceased contributor
  - <65 years - $91.06 plus 37.5 per cent of current value of retirement pension
  - maximum $273.35 per month
  - >65 years - 60% of current value of retirement pension
  - maximum $291.67 per month

c) Orphan's Benefits - to orphans of deceased contributor
  - $91.06

(iii) GUARANTEED INCOME SUPPLEMENT - GIS

a) Single, Married, or Divorced Pensioners
- if yearly income (excluding OAS) is less than $8,200
- supplement of income varies according to income
- maximum $342.68

b) Married Couples - Both Pensioners
- for combined yearly income of less than $10,750
- supplement of income varies according to income
- maximum $233.18 per pensioner per month

c) Married Couples - One is not a Pensioner
- for combined yearly income of less than $19,967
- supplement of income depends on income
- maximum $342.68 per pensioner per month

(iv) SPOUSES ALLOWANCE

a) Married
- if spouse of pensioner is between 60 and 65 and combined couple income is less than $15,400
- supplement to spouse of up to $511.52 per month

b) Widowed Spouse
- if yearly income is less than $11,300, can be supplemented up to $564.74 per month

(v) EMERGENCY FINANCIAL ASSISTANCE

- available to help pay for subsistence if no other income is available
- available to those individuals who do not qualify for OAS

VETERANS AFFAIRS CANADA

i) WAR VETERANS ALLOWANCE

- eligibility: - if their war service, age or incapacity, income level and residence meet the requirements of the Act.
- requirements of the Act include:
  -served in WWI, WWII, or Korean War
  -receiving a disability pension, or have accepted a commuted pension for an injury or disease suffered or aggravated during wartime service
  -served in UK during WWI
  -also must have been living in Canada at time of joining the forces or have lived in Canada for total of at least ten years

ii) CIVILIAN WAR ALLOWANCE

- eligibility: - served in close support of the Armed Forces
- some examples include:
  -merchant seaman, voluntary aid, detachment (WWI), firefighters (WWII).

Amounts: the recipient may receive an amount of allowance which when added to his/her assessable income, brings the total income up to that set maximum level
- for both War Veterans Allowance and Civilian War Allowance

Status	Maximum Monthly Income Level
Single Widow/Widower	$ 689.19
Single Widow/Widower blind within the meaning of the Blind Persons Act	718.06

Widow/Widower with one child	1046.42
Additional for each dependent child	123.25
Married	1046.42
Married and blind. or whose spouse is blind within the meaning of the Blind Persons Act	1075.22
Additional for each dependent child	123.25
Each orphan - established in 1984	369.34

ENERGY MINES AND RESOURCES CANADA

(i) CANADA OIL SUBSTITUTION PROGRAM - COSP

- assists homeowners to change from oil to alternative fuels
- house must have been constructed prior to October of 1980
- up to $800 grant
- program cancelled March 31, 1985

(ii) CANADIAN HOME INSULATION PROGRAM - CHIP

- offers taxable grants to cover 60% of costs of material for conversion from oil
- maximum $500 grant
- program cancelled March 31, 1986

EMPLOYMENT AND IMMIGRATION CANADA

(i) UNEMPLOYMENT INSURANCE - UI
AGED 65 SPECIAL BENEFIT

- a one-time lump sum is paid to anyone aged 65 who has worked and paid UI premiums for 20 weeks during the previous year
- the payment is 3 x 60% of average weekly income
- for example, if Mr. Jones was earning an average of $300 per week, his Aged 65 Special Benefit would total $540

PROVINCIAL PROGRAMS

MINISTRY OF REVENUE

(i) PROPERTY TAX GRANTS

- intended to reduce the amount of property tax paid
- based on the amount of rent or property tax paid, regardless of personal income level
- residents aged 65 and older and who do not qualify for OAS may be eligible for Property Tax Grants
- must be 65 years of age or older and pay property tax or rent on principal residence in Ontario
- as a homeowner, the lesser of $500 or the total amount of property tax is refunded
- as a tenant, the lesser of $500 or 20% of total rent is refunded

(ii) SALES TAX GRANT

- refund on provincial sales tax
- $50 mailed automatically to every citizen aged 65 and older
- mailed once a year

(iii) GUARANTEED ANNUAL INCOME SUPPLEMENT - GAINS

- monthly payment for those receiving GIS and whose income is lower than the minimum standard set by the province
- mailed automatically to those who already receive GIS and OAS pension
- geared to supplement income if below the guaranteed level
- Ontario's guaranteed income level for a qualifying single person is $707.15 per month and $588.95 per month for each spouse of a qualifying married couple
- the maximum monthly GAINS payment is $83 per qualifying pensioner

MINISTRY OF HOUSING

(i) ONTARIO HOME RENEWAL PROGRAM - OHRP

- established in 1974
- income of $19,000 or less may receive low-interest and/or forgivable loans of up to $7,500
- $4,000 of loan can be forgiven, remaining portion of returnable loan is due with 0 to 10% interest, depending on income level
- the program refers to the upgrading of the following: structural standards, heating, plumbing, and electrical services
- included in the heating guide are the following standards:

- every dwelling should facilitate an inside temperature of not less than 17 degrees celsius habitable rooms, bathrooms and toilet rooms
- all heating facilities should be properly installed and maintained in safe and good working condition
- doors and windows should prevent drafts and minimize heat losses

(ii) PROPERTY TAX ASSISTANCE

- available in some municipalities to property owners, 65 and older, who receive GIS
- $50 credit towards property tax
- $150 municipal school tax credit (returnable on sale of house)

MINISTRY OF COMMUNITY AND SOCIAL SERVICES

(i) FAMILY BENEFITS FOR AGED

- monthly financial assistance for seniors in need who do not qualify for OAS
- unemployable people between 60 and 64 years of age may also qualify
- available to people 65 and older who need financial assistance but do not qualify for OAS pension, usually because they have not lived in Canada for 10 consecutive years

MINISTRY OF HEALTH

(i) THE ACUTE HOME CARE PROGRAM

- provides rehabilitation services for 1 month to enable recipients to return to independent living
- expenses covered by OHIP

(ii) THE CHRONIC HOME CARE PROGRAM

- provides supportive home care as long as is required
- expenses covered by OHIP (iii) ONTARIO HEALTH INSURANCE PLAN-OHIP
- citizens aged 65 and older (or spouse) who have lived in Ontario for past 12 months may be entitled to full coverage under OHIP without having to pay premiums
- must apply for this benefit

ONTARIO HYDRO

(i) RESIDENTIAL ENERGY ADVISORY PROGRAM - 1981

- all owned residences are eligible for up to $3000 five year loans for energy conversions, improvements

IUS PUBLICATIONS

REPORTS

The Evolution of Urban Canada: An Analysis of Approaches and Interpretations, Report No. 4 by A.J.F. Artibise and P.-A. Linteau.

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Public Transit and the Public Interest: An Empirical Evaluation of Two Administrative Models, Report No. 15 by F. Frisken.

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URBAN RESOURCES SERIES

The Windsor Municipal Archives: Heritage Development in Hard Times, Urban Resources Series No. 1, by M. Walsh.

WINTER COMMUNITIES SERIES

Planning in Cold Climates: A Critical Overview of Canadian Settlement Patterns and Policies, Winter Communities Series No. 1 by X. Zepic and N. Pressman.

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THE INSTITUTE OF URBAN STUDIES

The Institute of Urban Studies (IUS) was created by the University of Winnipeg in 1969 at a time when the city's "urban university" perceived a need to address the problems and concerns of the inner city. From the outset, IUS was both an academic research centre and an innovative, action-oriented community resource. The Institute has always been committed to examining urban development issues in a broad context and has never lost sight of the demands of applied research aimed at practical, often novel, solutions to urban problems. In recent years, however, IUS has expanded its research mandate to include the examination of issues faced by rural, remote and northern communities with a special focus on western Canada and the North.

The Institute of Urban Studies is a multiple-function centre that undertakes to encourage, facilitate and engage in independent, multi-disciplinary research on a select range of topics (including housing, community and neighbourhood development, urban policy and municipal government, community economic development, program and agency evaluation, and social-demographic issues); to promote and engage in formal and informal education and community outreach programs (including an undergraduate urban studies majors program, workshops, conferences, seminars, etc.); and to conduct mission-oriented and applied research.

The Institute has an active publications program that includes a major scholarly journal, a quarterly newsletter, major reports, research and working papers, monographs, and occasional publications.

The Institute is an institutional member of the following organizations: the Social Science Federation of Canada, the Association for Canadian Studies, the Urban Land Institute, the Urban Affairs Association, the International New Towns Association, the International Federation for Housing and Planning, the Association of Canadian University Planning Programs, the Canadian Council on Social Development, the Canadian Urban History Association, the Canadian Association of Housing and Renewal Officials, the Livable Winter City Association, the International Downtown Executives Association, the Canada West Foundation, the Canadian Association of Threatened Single Industry Towns, the Social Planning Council of Winnipeg, the Downtown Winnipeg Association, and several other local or regional bodies.

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